Dr. Andy Toy

THE OCCLUSION STORY

PART 1: BUILDING THE RIGHT BITE

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The Occlusion Story

This eBook will challenge Bonwill and Angle's concepts of Occlusion and introduce some of the evidence for a new way of looking at the subject. Our evidence includes the equation that proves the functional connection between the posterior occlusion and the TM Joint. This functional approach is called 'Posterior Guided Occlusion' or 'PGO'.

There's a lot of confusion about Occlusion. It needn't be like that. This eBook will tell the story of how our current thinking on Occlusion came about. You will be surprised by Bonwill's Big Idea and how he influenced Edward Angle. I call this the 'Structural' Model of Occlusion.

IS OCCLUSION IMPORTANT?

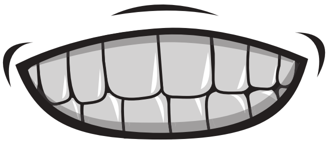
A lot of dentistry doesn't affect the patients occlusion that much so it's easy for them to adapt

Fortunately, the patient's system is very flexible and can adapt to most of the occlusal changes that dentists make. This means that patients rarely return with occlusal problems.

If you are making significant changes to a patient's occlusion, then you have a responsibility to understand what you are doing.

There are 4 Sections to this eBook:

1. What do we mean by the 'Right Bite'?
2. What is the evidence for the Structural Model of Occlusion?
3. Why do we think Angles Class 1 is so important?
4. Some of our evidence for the Functional perspective

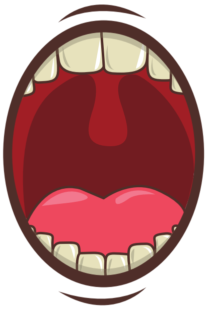


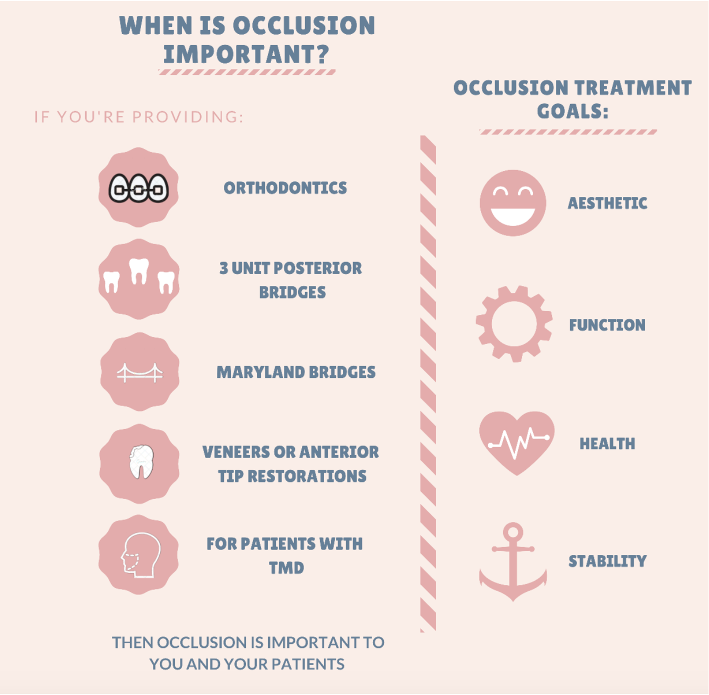
What is the right bite?

In my opinion, the right bite is one where the patient can:

1. Chew easily with no damage to the teeth, gums or TMJ.
2. Can maintain good oral hygiene
3. Will be reasonably stable over time
4. Looks aesthetically pleasing

That means the Right Bite is about the Right function.





WHEN IS OCCLUSION IMPORTANT?

IF YOU'RE PROVIDING:

- ORTHODONTICS
- 3 UNIT POSTERIOR BRIDGES
- MARYLAND BRIDGES
- VENEERS OR ANTERIOR TIP RESTORATIONS
- FOR PATIENTS WITH TMD

THEN OCCLUSION IS IMPORTANT TO YOU AND YOUR PATIENTS

OCCLUSION TREATMENT GOALS:

- AESTHETIC
- FUNCTION
- HEALTH
- STABILITY

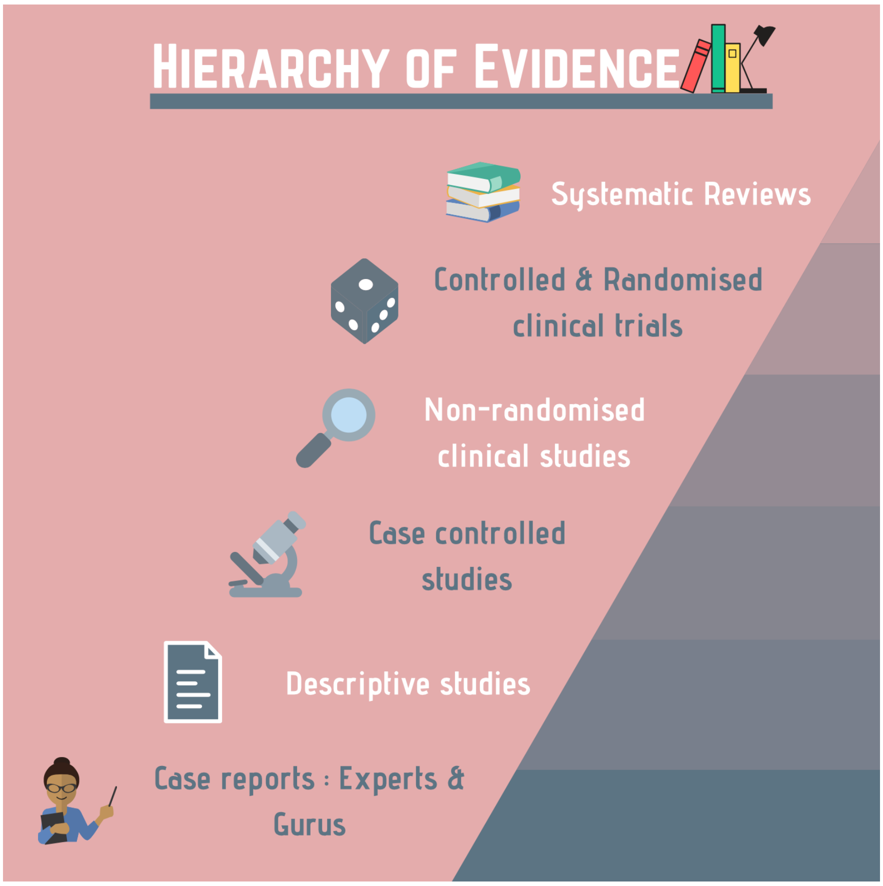
Why is this different to the way dentists have been taught about Occlusion? Traditionally, we learn about Occlusion in terms of the STRUCTURE such as Angle's Class 1, 11 or 111. Little attention is paid to how the patient FUNCTIONS.

Modern clinical techniques, such as composite bonding, have the potential to alter the patients Occlusion for the worse, leading to pain, tooth-mobility or early-failure of restorations.

What is the current evidence for the "Structural' perspective?

The Evidence Base for Current Models of Occlusion is Poor.

There have been 5 Cochrane Systematic Reviews about Occlusion and/or TMD treatments. None of them have provided the highest level of evidence in favour or against the current models of occlusion. We are therefore reliant on the views of 'experts' and our own clinical experience. When you are relatively new to dentistry than you are more reliant on the former!



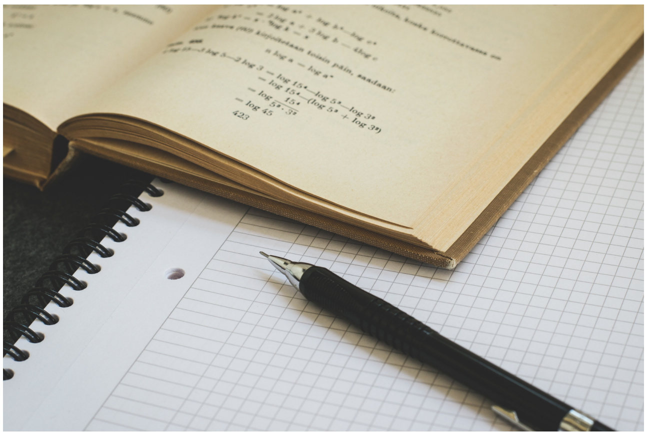
HIERARCHY OF EVIDENCE

- Systematic Reviews
- Controlled & Randomised clinical trials
- Non-randomised clinical studies
- Case controlled studies
- Descriptive studies
- Case reports : Experts & Gurus

There are only 5 Cochrane Systematic Reviews to date

Occlusal interventions for periodontitis in adults 2008 [Weston P, Yaziz YA, Moles DR, Needleman 1]

Occluusal splints for treating sleep bruxism (tooth grinding) 2007 [Macedo CR, Silvia AB, Machado MAC, Saconato H, Prado GF]



Occusal adjustment for treating and preventing temporomandibular joint disorders 2003 [Koh H, Robinson P]

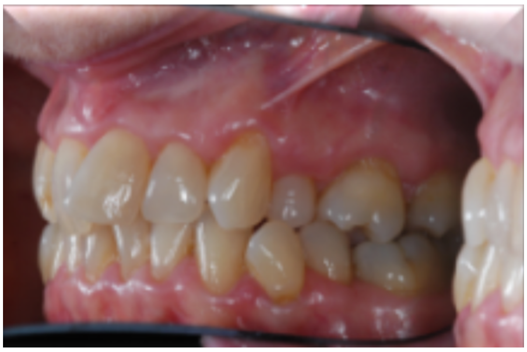
Stabilisation splint therapy for temporomandibular pain dysfunction syndrome 2004 [Al-AniMZ, Davies SJ, Gray RJM, Sloan P, Glenny A]

Occusial interventions for periodontitis in adults 2008 [Weston P, Yaziz YA, Moles DR, Needle- man 1]

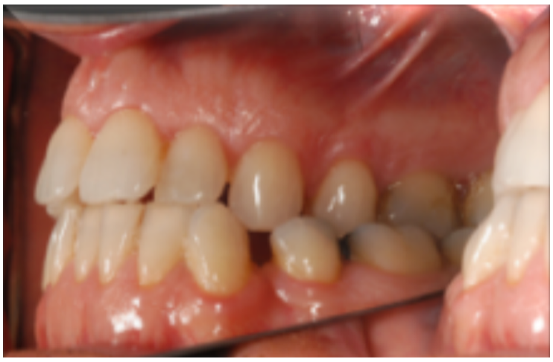
Look at your own patients

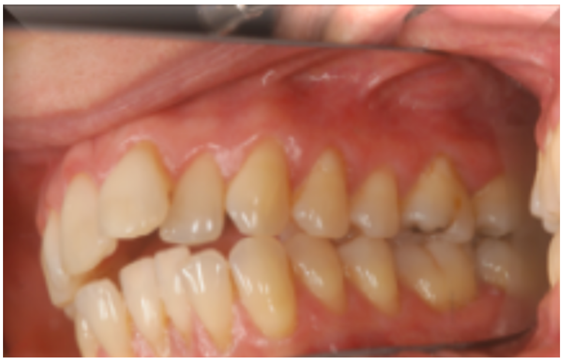
How many of your own patients have the 'ideal' Angle's Class 1 with canine guidance and immediate posterior disclusion on the opposite side?

I'll bet it's not many! Beyron et al* found that canine guidance and posterior disclusion on the opposite side disappeared when the subject was asked to bite WITH FORCE. We have observed the same with 200+ dentists in our study clubs.



It is NORMAL to have guidance on the posterior teeth on BOTH sides and canine guidance is NOT essential for good health and function.





How many of your own patients who don't have the 'ideal' occlusion have signs of TMD or are unable to chew in comfort? Again, I'll bet it's not many! For instance, see these pictures of patients who have been monitored for TMJ function and occlusal problems for at least 10 years. They all have comfortable, functional occlusions with great TMJ function none of them are Angle's Class 1.

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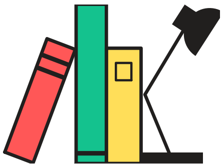
*Beyron, H. Acta Odont. Scandinavica 1964: 22, 597 - 678

Why do we think Angle's Class I is so important?



BONWILLS BIG IDEA

Dr. Bonwill was an American dentist and one of the first to publish on dental occlusion. He stated:

"The proportions of the human body are founded on an equilateral triangle...most clearly manifest in the architecture of the jaws and teeth....exactly 4 inches on a side".

He came to this conclusion after a dream, during which he believed he had been visited by God:

"I am willing to die knowing that it was as pure a revelation and inspiration...as the laws of (planetary) motion were to Kepler"

If the architecture of the jaws and teeth are based on an equilateral triangle, then the two sides of the face must be perfectly symmetrical...

Dr. WGA Bonwill 1833-1899

How many patients have YOU seen with jaws, dental occlusion and faces that are perfectly symmetrical? I'd guess it was none! Bonwill's statement is not based on scientific evidence OR clinical observation.

Angle's Classification

Dr. Edward Angle was a student of Dr. Bonwill. He believed that:

> 'Each dental arch describes a graceful curve (based on Bonwill's triangle) and the teeth in these arches are so arranged as to be in the greatest harmony with their fellows in the same arch, as well as those in the opposite arch.'

Through Angle's Classification, Bonwill's Big Idea became embedded into how we describe and understand occlusion today.

Bonwill and Angle believed that occlusion could be described in terms of perfect STRUCTURE. Attempts to find scientific evidence for this idea have failed. Three independent research panels concluded:

"A precise, clinically meaningful definition of malocclusion did not exist." *

* Ackerman, Ackerman and Kean, A Philadelphia Fable: How Ideal Occlusion Became the Philosopher's Stone of Orthodontics, Angle Orthodontics; 77:1, Jan.2007, pp 192-3.

The Functional Perspective

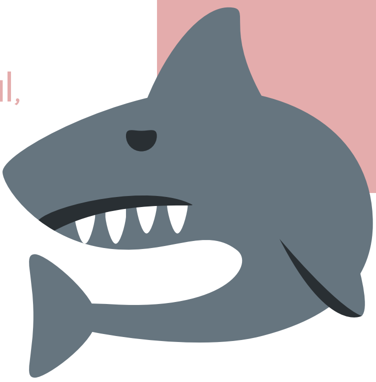
Anthropological Evidence

We now turn to some of the evidence behind the PGO, functionally-driven model of occlusion.

It starts with Anthropology, which is the study of humankind in all its aspects, especially human culture or human development.

In Anthropology, successful genetic traits are evidence of positive, well-established and 'normal' phenotypes.

In the example of the shark, its body has barely changed form in over 200 million years. This is evidence of a successful, 'normal' phenotype or morphology.



Anthropological Principles of Occlusion

Asymmetry is normal

Some occlusal wear is normal

Muscles should be 'turned on'

The TMJ adapts to function

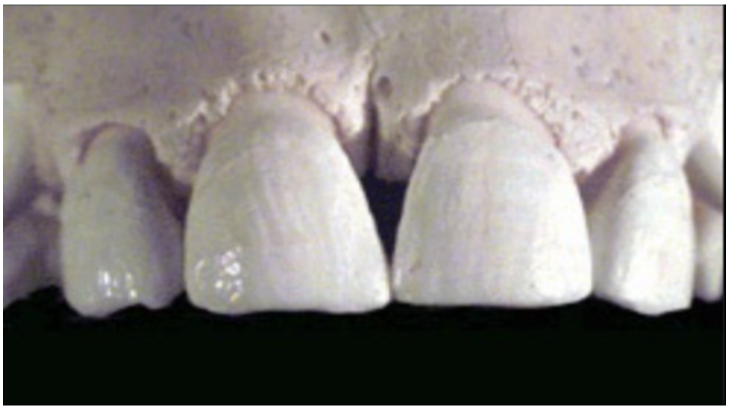
The Functional Perspective

Dental Anthropology

What can Dental Anthropology tell us about the normal morphology of teeth and the relationship between occlusion and TM joint function?

These teeth look pretty contemporary, don't they? In fact, they are from human and ape specimens between 200,000 and 4.5 million years old.

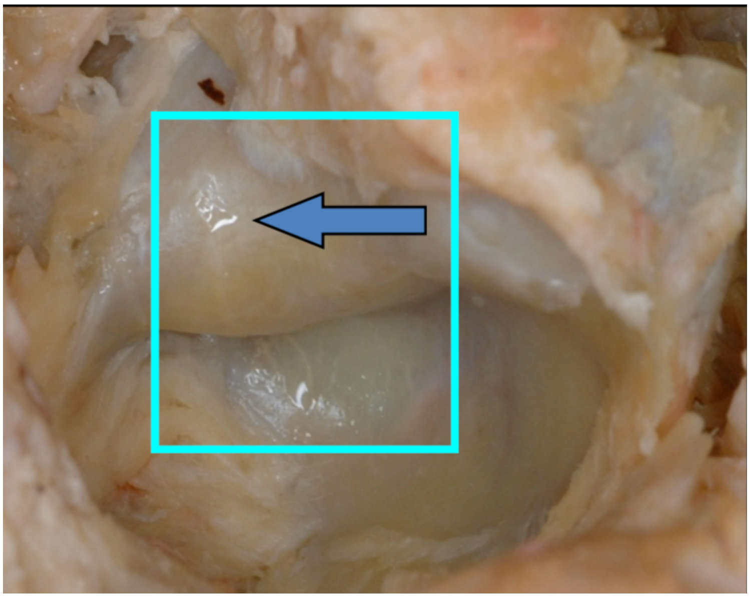
This tells us that teeth have barely changed in many millions of years. So the study of historical specimens can provide insights into how our present day teeth and TM joints should work together. This is very helpful as the dissection of live specimens is very challenging!



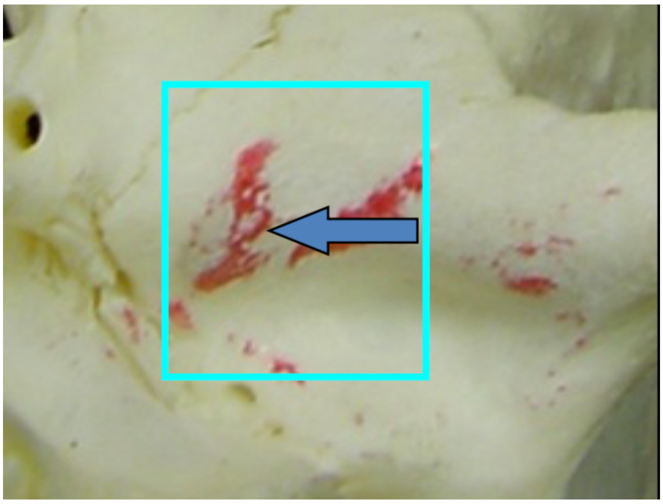
The Functional Perspective

Dental Anthropology

Zola's Tubercle is the part of the Glenoid Fossa that has the greatest thickness of bone and cartilage. This indicates it is the stress-bearing part of the TM joint.



You can see the area indicated by the glistening white line in the top image. In the lower image the pressure point is indicated by the area where the red ink from the articulating paper has been 'squeezed' out.

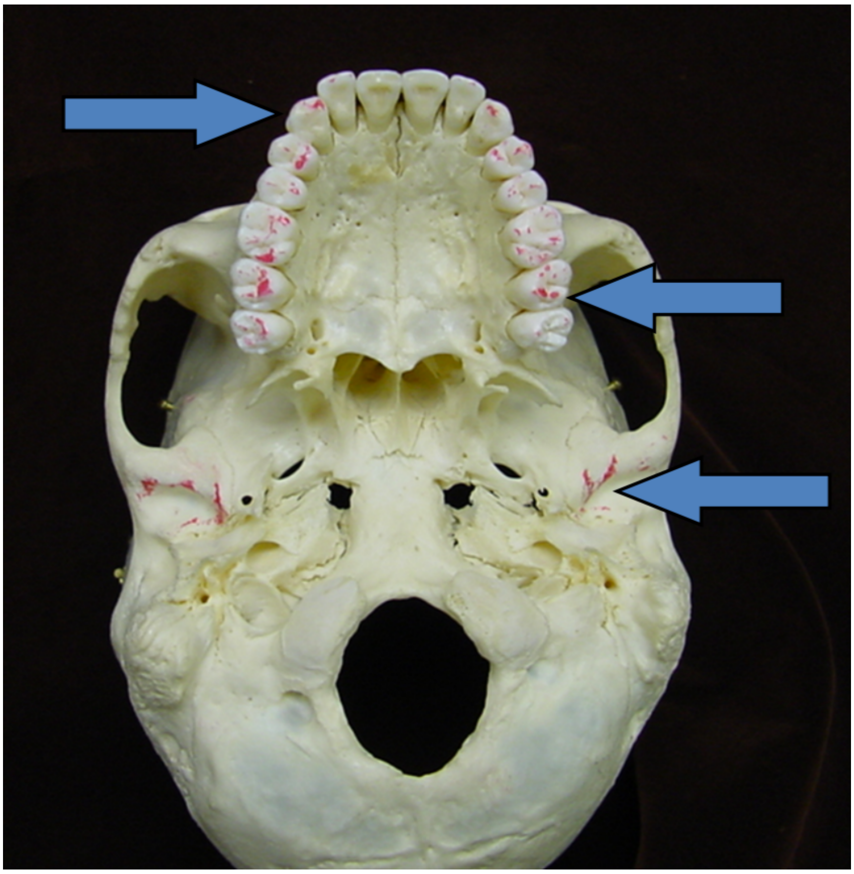


Dr. Ron Presswood compared left and right TM joints on over 500 dry-skull anthropological specimens and found that every one had asymmetrically shaped Zola's Tubercles. This is a piece of evidence against Bonwill and Angle's model of symmetrical 'Structural' model of occlusion.

The Functional Perspective

Dental Anthropology

Ron's supposition from his studies indicated that there was a relationship between the functional surfaces of the TM joint (Zola's Tubercle) and the functional surfaces of the posterior teeth - posterior guided occlusion (PGO)

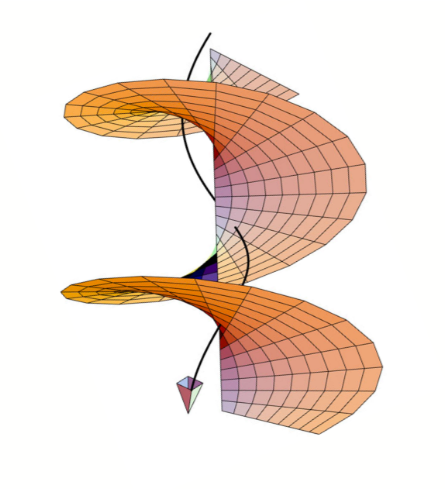


If this was the case, then it should be possible to devise a mathematical equation that would describe that relationship. If this was not the case (the surfaces were at completely random plane angles), then no mathematical relationship could be found.

Ron employed a NASA Space Engineer to scan 12 skulls of various sizes to an accuracy of 10 microns and compare the plane angles of Zola's Tubercle, the mesiopalatal cusp of the non-working (or balancing side) and the canine of the working side indicated by the blue arrows in the image.

The Functional Perspective

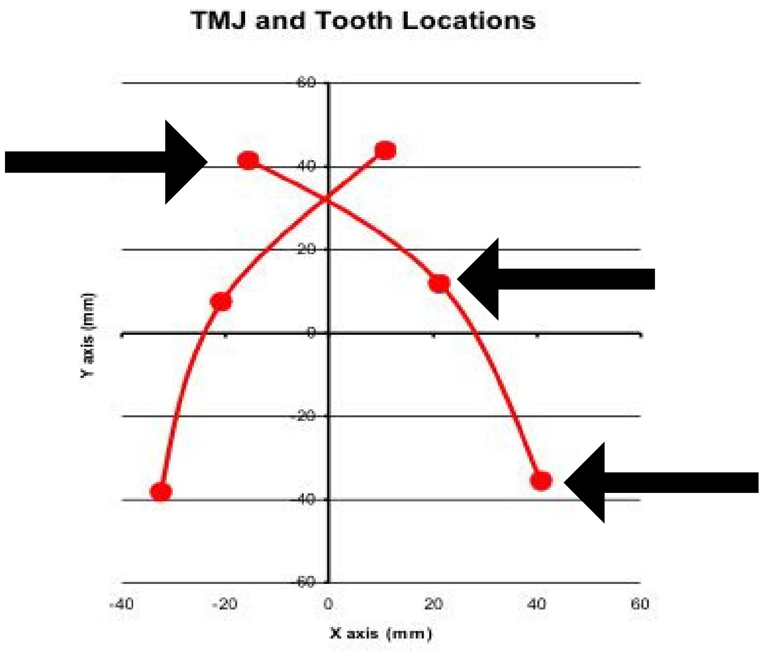
A Mathematical Proof for PGO



The relationship did exist and was described using non-linear maths. Interestingly, this form of maths was not available to Bonwill, Angle and their co-workers at the turn of the 19th/20th centuries. Their conceptual framework was linear, so perhaps it is not surprising that they came to their conclusions.

No other model of Occlusion has a mathematical proof to support it.

The study confirmed Ron's clinical experiences and was in line with the anthropological evidence available. It takes the form of a parabolic curve and the paths of the individual condoles are asymmetric.



The full equation is not shown here for reasons of commercial sensitivity. To date, no virtual articulator has incorporated this equation into their software, so cannot reasonably claim to replicate reality when creating a 3D Model.

$$\begin{bmatrix} \cos\Phi + E_{Rx}^2(1-\cos\Phi) & \text{[redacted]} & E_{Rx}E_{Rz}(1-\cos\Phi) - E_{Ry}\sin\Phi \\ E_{Rx}E_{Ry}(1-\cos\Phi) - E_{Rz}\sin\Phi & \cos\Phi + E_{Ry}^2(1-\cos\Phi) & \text{[redacted]} \\ \text{[redacted]} & E_{Ry}E_{Rz}(1-\cos\Phi) - E_{Rx}\sin\Phi & \cos\Phi + E_{Rz}^2(1-\cos\Phi) \end{bmatrix}$$

In Conclusion

Thanks for reading this short eBook. I hope you now have a clearer distinction in your mind about two schools of thought in dental occlusion. The 'Structural' school developed out of the ideas of Bonwill and Angle and has dominated our thinking on occlusion throughout the 20th and 21st Century. However, it is impossible to find a patient with a truly symmetrical relationship between jaws and teeth - the Structural model does not exist in nature.

There is another school of thought, based on a 'Functional' perspective and named here as the Posterior-Guided model of Occlusion ('PGO'). Many dentists have already chosen this model by deciding not to restore every patient they treat with canine-guidance, or finish an orthodontic case without the so-called 'ideal' Class 1 relationship. They probably chose the PGO model unknowingly because it 'seems to work' in their patients.

Their choice actually has some very significant evidence behind it - including anthropology and a mathematical equation. The PGO model describes more of what we see in our own patients than any other I have come across. I hope you will now be able to see that, too. Future modules will go into greater depth about why PGO works so well and how you can apply it purposefully in practice. Stay connected for more insights and support in your learning.

Connect with me on Facebook, LinkedIn, Instagram and Twitter for more insights into (among other things) Occlusion, Ethical Sales & Consent, Invisalign and 'A Life in Dentistry' - I would love to hear from you!

Andy Toy

Dr. Andy Toy

MMedSci BDS MFGDP(UK)

Dr. Andy Toy qualified as a dentist in 1980 from the University of Bristol. Since that time, Andy has made himself a devoted student of occlusion. He attended his first course on occlusion in 1982 with Dr. Jim Orr and Dr. Roy Higson (who later founded the British Society of Occlusal Studies 'BSOS'). Andy attended the L.D.Pankey Institute (USA) later that year and has since completed all of their Continuum Series, joined their Teaching Faculty and has had a spell on their Advisory Board.

Andy became interested in the quality of clinical evidence whilst teaching Research Methodology on the Clinical Education Masters course for University of Nottingham (a post he held for 10 years). He also attended the Centre for Evidence-Based Dentistry at the University of Oxford in 2002. These experiences led him to critically evaluate the evidence behind his beloved topic of occlusion and he found it seriously wanting!

It would appear that there was very little evidence for the accepted models of occlusion, other than an Expert's opinion. Did occlusion really matter? He couldn't deny his 20 years of clinical experience that 'correct' occlusion was an important aspect of dental care.

Dr. Andy Toy

MMedSci BDS MFGDP(UK)

On a BSOS Study Trip to the Parker Mahan Facial Pain Clinic at University of Florida in 2003, Andy met Dr. Ron Presswood DDS. Ron described a model of occlusion called 'PGO' (posterior guided occlusion). PGO appeared to contradict many of the principles that Andy had spent hundreds of hours studying over the previous 20 years.

It would have been easy to dismiss Ron as just another Occlusion Guru, but Ron had already gathered a considerable amount of high quality scientific evidence to back up his claims. So Andy felt he had to take him seriously and invited Ron to come to run regular study clubs at his practice in Loughborough, UK, so that he could gain a deeper understanding of the principles and practice of PGO.

During this period, Ron and Andy became part of a research group at the world-renowned School of Sport and Exercise Science at Loughborough University. The group has published a number of peer-reviewed papers around dental occlusion and oral-muscle function. The group also created a revolutionary full-denture system called CQR (www.cqrdentures.com) and the world's first articulator to replicate natural, non-linear condylar function ('The Condor').

Andy has successfully applied the principles of PGO occlusion to his own Invisalign practice of over 700 patients, with many of them reviewed over 5+ years. The patients continue to function happily in comfort with their new smiles and no long term side-effects.

Dr. Ron Presswood

DDS RDT

Dr. Ron Presswood qualified as a dentist in 1965 from the University of Texas. Whilst teaching and studying in the 1980s with Dr. Parker E. Mahan, Univ. of Florida and Dr. Henry M. Tanner, USC and Univ. of Utah. It became clear that the 'Structural' description of occlusion that was current at the time did not adequately describe the neuro-muscular and musculoskeletal dynamics of human occlusal function they were observing in their clinical practices. Ron embarked on reviewing and gathering evidence for an alternative perspective, based on a 'Functional' approach to occlusion.

Between 1988 and 1993 Ron studied over 2000 papers related to surface electro-myograph (SEMG) studies - a relatively new discipline at the time. He also reviewed all major textbooks available on dental occlusion. In 1993,

Ron undertook his own SEMG studies combined with clinical observations of over 100 dentists. He found that all the subjects had 'non-working' or 'balancing' side occlusal contacts on posterior teeth when they chewed in FUNCTION.

The group also created a revolutionary full-denture system called CQR (www.cqrdentures.com) and the world's first articulator to replicate natural, non-linear condylar function ('The Condor').

Dr. Ron Presswood

DDS RDT

In the mid 1990s, Ron undertook a photographic study of over 500 dry skulls looking at the Zola's tubercle in the Glenoid fossa. Zola's tubercle can be regarded as the area which articulates with the condyle during function. He found significant asymmetry between left and right sides in every case. Subsequently, a random selection of 12 skulls of various sizes was scanned to determine if there was a relationship between what was suggested to be functioning surfaces of the teeth (occlusal contacts on the non-working surfaces of the posterior teeth) and the functioning surface of the TMJ Zola's tubercle.

A relationship was found and can be described by a mathematical equation indicating the paths of motion are non-linear and asymmetric form. This mathematical equation applies to all sizes of skull and is the strongest piece of evidence for the functionally-driven PGO model of occlusion.

In the early 2000s Ron made 7 trips to the Anthropology Faculty of Adelaide University Dental School, where they have the world's largest continuous study of human growth and development. Radiographs and accurate study models of over 1000 individuals demonstrate that nearly all of them have well-aligned adult dentition by the age of 14 and also some occlusal wear, probably as a result of their diet. Some occlusal wear is regarded as beneficial for good TMJ function.

In the mid-2000s Ron became part of a research team at the world-renowned School of Sport and Exercise Science at Loughborough University with Dr. Andy Toy. The team have performed over 6000 SEMG tests on the major muscles of mastication in 64 individuals- more than any other team in the world to date. Their work has been published in the Journal of Oral Rehabilititation.